three-phase sine wave generator

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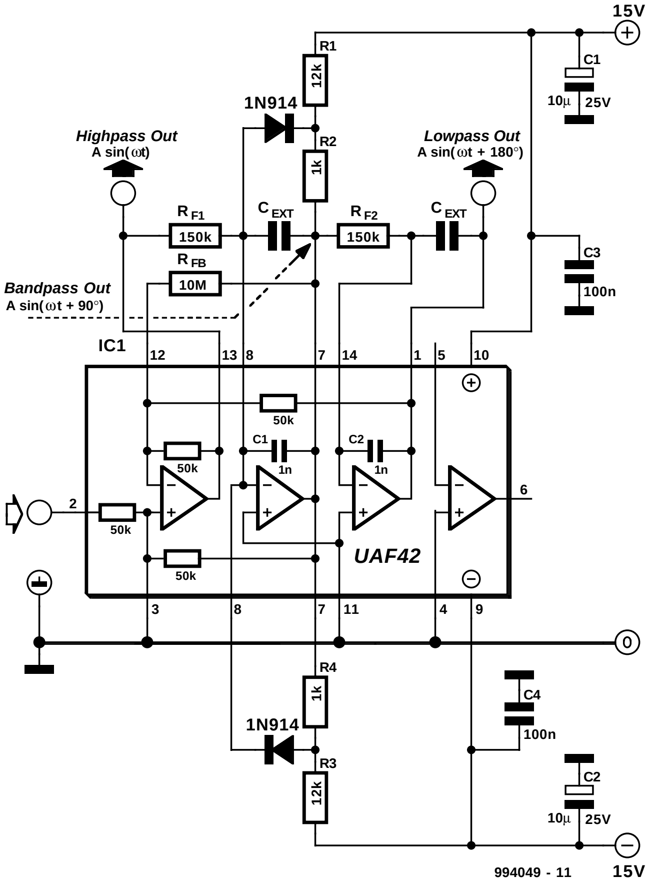

A Burr-Brown application

The diagram shows how a three-phase sine wave oscillator can be built with a single Type UAF42 state-variable filter and some resistors and diodes. Three output nodes are available: high-pass out, band-pass out, and low-pass out. The signal at the band-pass and low-pass out nodes is 90° and 180° out of phase, respectively, with that at the high-pass node. An on-chip auxiliary op amp is available for use as a buffer or amplifier stage.

The frequency of oscillation is set with resistors R_{F1} and R_{F2} according to

$$f_{OSC} = 1/2\pi RC,$$

where

$$R = R_{F1} = R_{F2}$$

and

$$C = C_1 = C_2 = 1000\ \text{pF}$$

The maximum frequency of oscillation obtainable with the UAF42 state-variable filter is 100 kHz. Distortion becomes a factor, though, for frequencies above 10 kHz. For frequencies of oscillation below 100 Hz, the use of external capacitors is recommended. These should be placed in parallel with the internal capacitors C_1 and C_2. This will reduce the requisite values of R_{F1} and R_{F2}. The external capacitors should preferably be NP0 ceramic or mica types.

To obtain the requisite output levels, resistors R_1–R_4 should meet the following requirement:

$$R_1/R_2 = R_3/R_4 = (V_O + V_S)/(V_O - 0.15) - 1$$

The values indicated in the diagram apply to a frequency of 1 kHz.

At this frequency,. the external capacitors may be omitted, since the internal ones are sufficient.

The actual output level may differ slightly from the calculated one owing to non-ideal operation of diodes and op amps. It may therefore be necessary to adapt the ratios R_1/R_2 and R_3/R_4 to some extent.

Positive feedback necessary for the onset of oscillation is provided by coupling the output of the band-pass section to the input of the summing amplifier via resistor R_{FB}. Suitable values for this resistor are 10 MΩ for $f > 1$ kHz, 5 MΩ for $f = 10–1000$ Hz, and 750 kΩ for $f < 10$ Hz. Smaller values result in an increase in the output level and, consequently, distortion.

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